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ABSTRACT

The Swassing-Barbe Modality Index (SBMI) uses visual, auditory, and tactile inputs, but only reconstructed output, to measure children's modality strengths. In this experiment, the SBMI's three input modalities were crossed with two output modalities (spoken and drawn) in addition to the reconstructed standard to result in nine treatment conditions. Forty 4-year-old and 40 7-year-old children (half of each gender in each age group) from preschools and an elementary school in a suburban area of a southeastern city completed all of the study tasks. Teachers rated their visual, auditory, and tactile characteristics along a seven-point scale, and gave an overall ranking to the child. Only 1 child's strengths were the same in all 3 response modalities, 33 children's strengths were the same in 2 response modalities, and 46 children's strengths were different in all 3 response modalities. Results suggest that modality strength depends on response modality, that strengths and preferences are different, and that teachers' evaluations are unrelated to children's task performance. The lack of connection between the SBMI and achievement found in previous research may be due to the difference in response modality, given that the SBMI has relied on tactile characteristics, while achievement tests use written characteristics. One table and six figures illustrate the results. (SLD)

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Response modality variations affect determinations of children's learning styles

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ABSTRACT

The Swassing-Barbe Modality Index uses visual, auditory, and tactile inputs, but only reconstructed output, to measure children's modality strengths. This experiment added spoken and drawn outputs in a within-subjects repeated measures design using four- and seven-year-old children. Response modality affects both memory performance and modality strengths, measured by raw and transformed scores, respectively.

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INTRODUCTION

Prior research using the Swassing-Barbe Modality Index (SBMI) has failed to demonstrate a significant connection between modality strength and academic achievement. However, the SBMI itself may be insufficiently understood as a dependent measure. Given findings from both psychophysical and memory research suggesting that response modality affects task performance, the SBMI's three input modalities (visual, auditory, tactile) were crossed with two output modalities (spoken, drawn) in addition to the reconstructed standard, resulting in nine treatment conditions.

The first hypothesis was that these variations in response modality would be significant. A second question involved analyzing both raw scores of correctly recalled shapes and transformed scores, where each treatment is expressed as a percentage of the total raw score. This transformation produces the profile of a child's modality strengths. A third question concerned whether children's self-reported modality preferences and teachers' evaluations of children's modality strengths would be related to task performance.

METHOD

Forty four-year-old and 40 seven-year-old children were recruited from preschools and an elementary school in a suburban area of a southeastern city. Half of each age group was of each gender. Ages were selected based on prior research suggesting differences between modality strengths and preferences. Additionally, developmental increases in internalized speech during this period suggested possible age differences in auditory input and/or spoken output. Age and gender were between-subjects variables, and input and output modality were within-subject variables in a repeated

measures design. Each child completed all nine tasks in one testing session lasting approximately 20 and 30 minutes for the younger and older children, respectively. Task order was randomly determined for each child.

Like a digit span test, the immediate recall tasks consisted of a series of shapes (circles, triangles, squares, hearts), increasing in length from one to a maximum of nine. Children were asked which input and output they liked, and selected a (primarily visual [stickers], auditory [kazoo], or tactile [yoyo]) toy. Teachers rated children's visual, auditory, and tactile characteristics along a seven-point scale and gave an overall percentile ranking of the child.

RESULTS

Only one child's modality strengths were exactly the same in all three response modalities; 33 were the same in two response modalities; and 46 were different in all three response modalities. Principal results were examined in 2 (age: 4, 7) x 2 (gender: male, female) x 3 (output: reconstructed, spoken, drawn) x 3 (input: visual, auditory, tactile) repeated measures analyses of variance, with separate ANOVAs performed on the raw and transformed scores. Pairwise comparisons used Fisher's protected LSD at $p<.05$. Table 6 presents the results of these ANOVAs.

Neither the children's stated input preferences, output preferences, nor toy selections vary as a function of age (x^2 (2) = .61, .37, 1.61, $p>.10$, respectively) or gender ($x^2(2)$ = .456, .35, 3.61, $p>.10$, respectively). Furthermore neither of the stated preferences predict toy selection (input r (58 df) = .235, n.s.; output r (67 df) = .028, n.s.) or task performance (input F (2, 114) = .019, p = .98; output F (2, 66) = .659, p = .52). Teachers' ratings of the children's visual, auditory, and tactile character-

Table 6: Analyses of Variance for Raw and Transformed Scores

		Raw			Transformed		
SOURCE	df	MS	F	p	MS	F	p
A (age)	1, 76	13,132.81	178.68	.0001	<.0E-7	.01	.92
B (gender)	1, 76	542.53	7.38	.008	<.0E-7	.01	.92
AB	1, 76	13.07	.18	.67	<.0E-6	2.23	.14
C (output)	2, 152	169.46	3.56	.0004	.014	9.46	.0001
AC	2, 152	61.35	3.02	.052	.009	6.17	.003
BC	2, 152	72.18	3.56	.03	.003	1.87	.16
ABC	2, 152	1.40	.07	.9	.0005	.32	.73
D (input)	2, 152	1540.85	50.68	.0001	.22	96.26	.0001
AD	2, 152	121.22	3.99	.02	.025	10.72	.0001
BD	2, 152	75.97	2.5	.086	.008	3.3	.04
ABD	2, 152	25.16	.83	.44	.0006	.26	.77
CD	4, 304	84.58	3.64	.007	.009	4.97	.0007
ACD	4, 304	56.07	2.41	.05	.008	4.46	.002
BCD	4, 304	19.61	.08	.5	.001	.73	.57
ABCD	4, 304	14.95	.64	.63	.002	.9	.46

istics do not predict task performance: teachers give higher ratings to children whose output preference is spoken (F (2, 132) = 3.4, p = .04) and whose toy selection is auditory (F (2, 154) = 5.46, p = .005).

RAW SCORES = MEMORY PERFORMANCE

Using raw scores as a measure of absolute memory performance, there is an interaction of input, output, and age, F (4, 304) = 2.41, p = .0491. When each age is then considered separately and stratified by gender, the results are marginally significant for the younger children, F (9, 147) = 1.90, p = .06, and highly significant for the older children, F (9, 147) = 3.78, p = .0003.

For the younger boys (see Figure 3a), spoken response results in the same pattern as the reconstructed standard. For the younger girls (see Figure 3b), spoken response results in the same pattern as drawn response. For the older boys (see Figure 4a), spoken response results in the same pattern as drawn response. For the older girls (see Figure 4b), drawn response results in the same pattern as the reconstructed standard.

TRANSFORMED SCORES = MODALITY STRENGTHS

Using transformed scores as a measure of modality strength (i.e., the relative strength of visual, auditory, and tactile inputs), there is an interaction of input, output, and age, F (4, 304) = 4.46, p = .002. When each age is then considered separately and stratified by gender, the results are not significant for either age group. The data were therefore collapsed across gender; and the input-output interaction is significant at both ages: for the younger children, F (4, 76) = 3.51, p = .01; and for the older children, F (4, 76) = 5.76, p = .0004.

Age 4

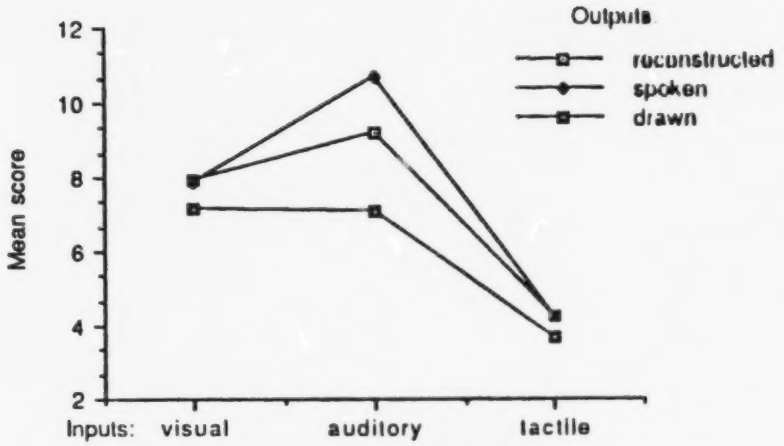

Figure 3a: Age 4 boys' raw scores

boys:	girls:
R: A>V>T	R: A>T
S: A>V>T	S: V=A=T
D: V=A>T	D: V=A=T

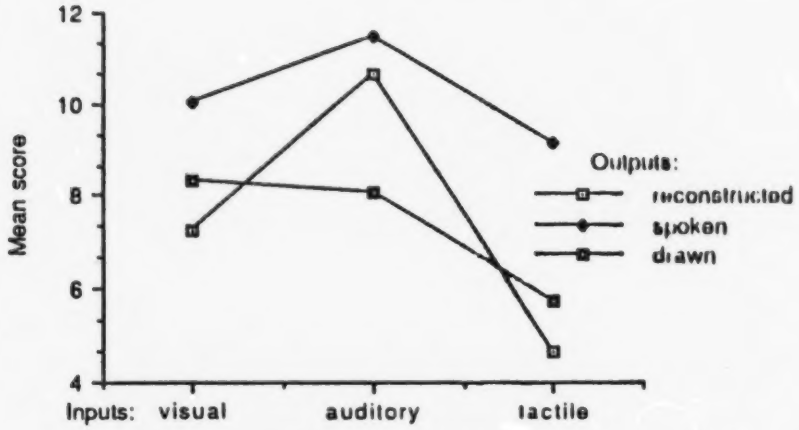

Figure 3b: Age 4 girls' raw scores

Age 7

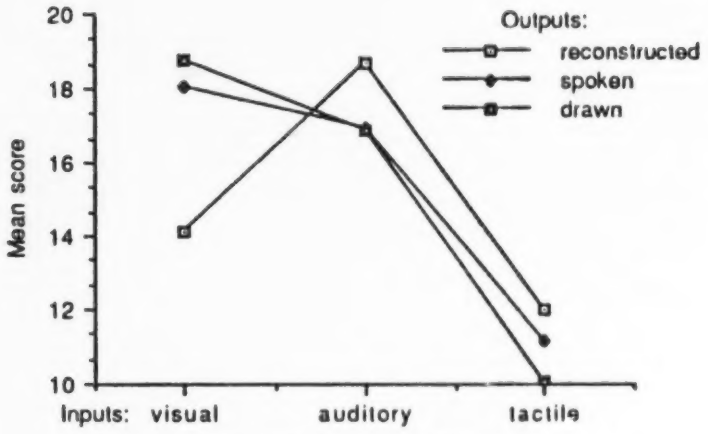

Figure 4a: Age 7 boys' raw scores

boys:	girls:
R: A>V=T	R: V=A>T
S: V=A>T	S: V>A=T
D: V=A>T	D: V=A>T

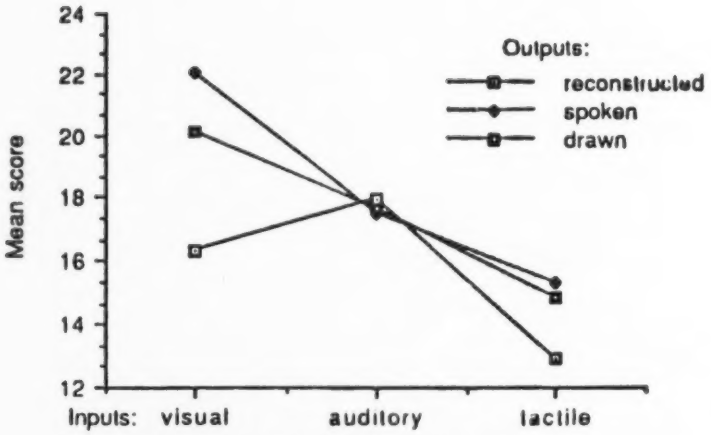

Figure 4b: Age 7 girls' raw scores

For the younger children (see Figure 5), spoken response results in the same pattern as the reconstructed standard. For the older children (see Figure 6), spoken response results in the same pattern as drawn response. Comparing Figures 5 and 6, it appears that the older children are more visual than the younger children, using both spoken and drawn responses.

CONCLUSIONS

Results suggest that: modality strength depends upon response modality; strengths and preferences are different; and teachers' evaluations are unrelated to children's task performance. The lack of connection between the SBMI and achievement found in previous research may be due to the difference in response modality, given that the SBMI has relied on tactile while achievement tests use written. The tactile response appears to be least adept in this experiment, despite being preferred by 62% of the children.

Researchers and educators should consider whether data collection and assessment strategies rely on a modality which may be neither the most adept for the task nor the stronger or most preferred by many respondents. Piagetian tasks commonly utilize visual stimulus and verbal response: for some, it may be easier to draw the answer and/or respond to auditory input. Measurements of field dependence utilize visual display and written response: some people may better hear embedded sounds than see embedded figures. In other words, Piagetian tasks and field dependence may be modality-specific.

Age 4

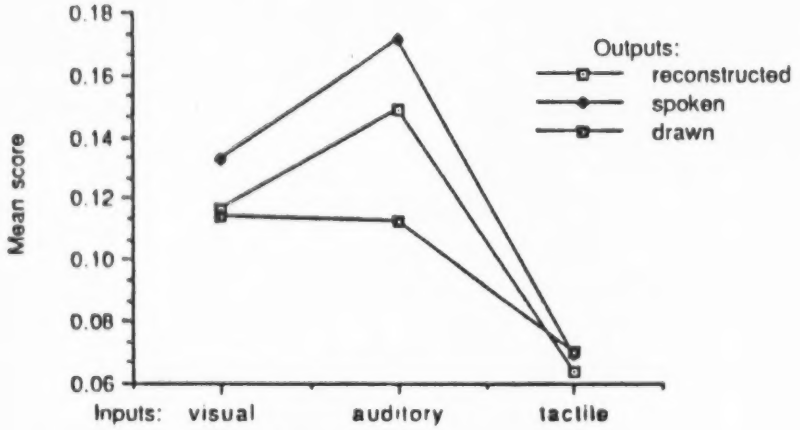

Figure 5: Age 4 transformed scores

R: A>V>T
S: A>V>T
D: V=A>T

Age 7

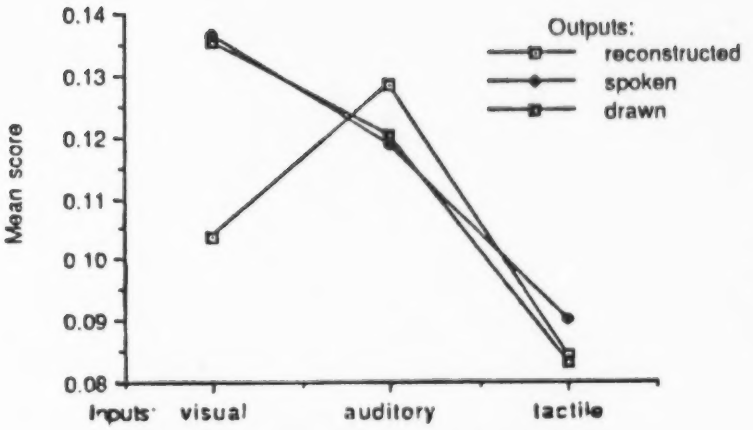

Figure 6: Age 7 transformed scores

R: A>V>T
S: V>A>T
D: V>A>T